ACCESSION #: 9009250282
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Brunswick Steam Electric Plant PAGE: 1 OF 21

DOCKET NUMBER: 05000324

TITLE: ESF Actuation/RPS Trip While Performing a Surveillance Test on Condenser Low Vacuum Instrumentation and Isolation Logic
EVENT DATE: 08/19/90 LER #: 90-009-00 REPORT DATE: 09/18/90

OTHER FACILITIES INVOLVED: Brunswick Unit 1 DOCKET NO: 05000325

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Wayne D. Link, Senior Generation Specialist

TELEPHONE: (919) 457-2054

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: -- COMPONENT: RV MANUFACTURER: T020
C TC BKR G080
C SF BKR G080
B BN BKR G080
C SJ LCV F130

REPORTABLE NPRDS: Y
Y
Y
Y
Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

While testing the main condenser low vacuum instrumentation and isolation logic, an isolation signal was generated which closed the main steam isolation valves. Closure of the main steam isolation valves initiated a Unit 2 reactor scram at 2154 on 8/19/90. Reactor pressure peaked at approximately 1133 psig and the minimum water level reached was

approximately 112 inches. No safety limits were exceeded in the plant response to the level and pressure transients. The operating crew was able to control the plant by using redundant equipment or alternate methods. The safety relief valve opening sequence and actuation pattern were questioned. The actuation pattern is not a concern. However, safety relief valve, B21-F013C (setpoint 1105 psig) did not open. The pilot valve assemblies were replaced on safety relief valves B21-F013A, B21-F013C, B21- F013G, B21-F013H, and B21-F013K.

Similar problems encountered during this scram have been reported in LERs 2-88-005, 2-88-019, 2-87-004, 1-87-011, 2-86-001, 2-86-013, 2-86-017, 2-85-003, 2-85- 011, and 1-85-033.

END OF ABSTRACT

[Amended to Lerform.]

EVENT

The Unit 2 reactor scrammed and a Group 1 isolation was received while surveillance testing was being performed on instrumentation and logic in the Primary Containment Isolation System (PCIS). During the scram recovery process, other Engineered Safety Feature (ESF) actuations and Reactor Protection System (RPS) trips were encountered. The minimum reactor water level reached was approximately 112" (low level 2) and reactor pressure peaked at approximately 1133 psig. No safety limits were exceeded during the plant response to the level and pressure transients.

INITIAL CONDITIONS

Unit 2 was operating at 100% power following recovery from a scram on 8/16/90. Unit 2 Emergency Core Cooling Systems (ECCS) were operable and in standby. Monthly testing of the main condenser low vacuum instrumentation and isolation logic was in progress. Channels A1(A) and B1(B) had already been completed.

EVENT DESCRIPTION

While plant Instrumentation and Control (I&C) technicians were performing surveillance test 2MST-PCIS24M, a monthly test of the main condenser low vacuum instrumentation and isolation logic, an inadvertent closing of the

main steam isolation valves (MSIVs) occurred. Closure of the MSIVs initiated a Unit 2 reactor scram at 2154 on 8/19/90. Between the time of the scram and 0236 on 8/20/90, the operating crew worked to establish stable shutdown conditions and identify problems encountered during the scram and subsequent recovery attempts. Following is a sequence of events describing the plant response and operator actions. Specific problems identified are addressed in more detail in the Event Investigation section of the Licensee Event Report (LER) and are cross-referenced to sequence of event times where possible.

SEQUENCE OF EVENTS

21:37:25 Testing is performed on Channel "A1".

21:39:20 The trip signal for Channel "A1" is reset.

21:44:01 Testing is performed on Channel "B1".

21:45:23 The trip signal for Channel "B1" is reset.

21:49:31 Testing is performed on Channel "A2". This channel is not reset as required by the procedure. The technician believes the trip has been reset and proceeds with the testing.

*21:54:48 Testing is performed on Channel "B2". When the trip setpoint is exceeded, a full Group 1 isolation signal is created. (ESF actuation)

*ESF Actuation
**RPS Trip

**21:54:48 The Main Steamline Isolation Valves (MSIVs) start closing. A scram signal is created on all four Reactor Protection System (RPS) channels. Control rods are inserted. (RPS trip)

*/**21:54:50 The closure of the MSIVs increases reactor pressure and creates a void collapse. All four RPS channels detect a low level (Low Level 1) and then all four channels detect the high reactor pressure created by the valve closure. (RPS trip)

The transient low reactor level (Low Level 1) creates

isolation commands for Group 2, 6 and 8. (ESF actuation)

The pressure transient also creates a sufficiently large disturbance to create the Group 1 isolation command in the "A1" and "B1" logic. The probable cause of the trip in these channels is from the high steam flow signal. The very high sensitivity D-P instrument is triggered by the pressure variations in the steam line during the closure of the MSIVs. (ESF actuation)

21:54:50/52 All 8 MSIVs are closed. Two valves (B21-F022A and F022B) close in less than 3 seconds. Valves B21-F016 and F019 (main steam line drain valves) are already closed per the normal operating procedure.

21:54:52 Decreasing reactor level creates an alternate rod injection (ARI) signal and generates an anticipated transient without scram (ATWS) signal to trip the Reactor Recirculation (RR) pumps. The RR pumps begin to coastdown.

*21:54:53 Reactor level continues to drop due to void collapse. Low Level 2 (LL-2) is reached. A Group 3 isolation command is generated. An auto start signal is generated for both the High Pressure Coolant Injection (HPCI) and Reactor Core Isolation Cooling (RCIC) systems. (ESF actuation) At LL-2, a start command is generated for Standby Gas Treatment (SBGT) and, an isolation signal is generated for Reactor Building Ventilation. (ESF actuation)

21:54:53/54 Responding to the Group 2 isolation signals, valves 2-G16-F003, F004, F019, and F020 (Drywell floor and equipment drain isolation valves) all go closed.

A trip of the operating Reactor Water Cleanup (RWCU) pump is received in response to the start of closure of the RWCU pump suction valves.

*ESF Actuation
**RPS Trip

21:54:54 Minimum water level is reached (approximately 112") on the initial void collapse.

21:54:55/56 The Reactor Building ventilation supply and exhaust dampers are closed.

21:55:05 Following EOP-1, Flow Path 3, the operator removes the mode switch from "RUN" and places it in "SHUTDOWN"

21:55:05 The generator trips, in turn creating a main turbine trip. All four Turbine Stop Valve (TSV) and all four Turbine Control Valve Fast Closure (TCVFC) signals are received in RPS. (RPS trip)

**21:55:05 RCIC is at speed, the injection valve (E51-F013) opens, and vessel injection is begun.

21:55:06/7 Transient level is recovered above Low Level 1 (162"). All 4 low reactor level channels reset.

21:55:08 The HPCI stop valve opens and the turbine accelerates. Since level has returned above the Level 2 setpoint, the injection valve will not receive a command to open. HPCI will run on minimum flow until secured.

*21:55:08/12 Because the reactor is isolated, pressure increases. At a pressure peak of about 1133 psi, Safety Relief Valves (SRVs) open automatically. According to the sonic detectors, valves (B21-F013 D, F and L) open for 3.2 to 4 seconds. From the tailpipe temperature readings, F013E also auto opened. (ESF actuation)

21:55:16 RWCU outboard isolation valve G31-F004 closed.

21:55:17/23 The 4 Hi-Hi Scram Discharge Volume (SDV) level trips are generated by the SDV level switches. The Hi SDV level rod block is also received. (RPS trip)

21:55:21 RWCU inboard isolation valve G31-F001 closed.
21:55:36 Reactor high level turbine trip is received; both feedpump turbines receive a trip signal.

21:55:42/3 HPCI and RCIC turbines automatically trip or shutdown. The RCIC injection valve goes closed.

(ESF actuation)

21:56:25 Since the condenser has been lost as a "heat sink", the operator manually opens SRV B21-F013B to lower pressure. The valve is held open for a little more than a minute. Pressure goes below the scram setpoint of 1045 psi; therefore, all four of the high reactor pressure scram signal reset. (ESF actuation)

*ESF Actuation
**RPS Trip

21:57:36 SRV B21-F013B closes. Rx. press. is about 910 psi,

21:57:57 Emergency Response Facility Information system (ERFIS) registers the outboard MSIVs B21-F028A and F028D going partially open. At the same time, the inboard valve B21-F022A starts alternating between open and closed, This is a detection or computer problem and does not reflect true valve position.

*21:58:58 SRV B21-F013F is lifted manually by the operator to maintain pressure below the scram point. (ESF actuation)

21:59:41 SRV B21-F013F closes. Pressure is about 900 psi.

*22:00 HPCI is started manually, and is placed in the "Pressure Control" mode. (ESF actuation)

22:04 RHR Loop "A" is started in torus cooling. (ESF actuation)

22:08 ARI is manually reset.

22:11 Groups 1, 2, 3 and 6 isolation logic is reset following level restoration.

*/**22:13 Reactor level drops below Level 1. All 4 low reactor level channels trip as well as the logic for Groups 2, 6 and 8. (ESF actuation/RPS trip)

*22:14 RHR Loop "B" is placed in torus cooling. (ESF actuation)

The outboard MSIVs are opened.

22:16 Outboard steam line drain valve B21-F019 is opened.
22:17 Inboard steam line drain valve B21-F016 is opened.

22:16 RCIC is started manually and injects. The rate of reactor level decrease is slowed but RCIC cannot supply sufficient inventory to account for steam load of HPCI.

22:24 Partial Group 1 isolation signal is received (Channel A2) due to a true low condenser vacuum. Steam is not available to drive the SJAEs.

22:25 HPCI secured from "Pressure Control" and used in the "Injection" mode, to fill the vessel. Level recovered to above low level 1.

*22:26/27 Full Group 1 isolation is initiated (Channel A1 and B1) on low condenser vacuum.

*ESF Actuation
**RPS Trip

The outboard MSIVs and the inboard steam line drain valve (B21-F016) go closed. The outboard drain valve remains open because the "B2" or "D" channel is still in test but is not tripped. (ESF actuation)

22:27 HPCI is returned to "Pressure Control" mode.

22:29 RCIC secured manually.

22:31 SDV high level is bypassed and the scram is reset.
22:34 HPCI is tripped due to high level. (ESF actuation)
22:39 Outboard steamline drain is closed.

22:40/42 Valves G31-F001 and F004 are opened to pressurize the RWCU piping and establish a reject path.

22:44 HPCI is restored to normal standby alignment.

22:47 The logic for Groups 1 (A1, A2, B1), 2 (A & B) and 6 (A & B) are reset.

22:48 The outboard MSIVs (F028A-D) and the two steam line drain valves (F016 and F019) are opened.

22:49 Computer scan is made of all rod positions. All rods are confirmed to be fully inserted.

23:04 RCIC started in "Pressure Control" mode, but is not able to maintain pressure low.

23:07 Started Motor Vacuum Pump to restore condenser vacuum.

23:08:41 RPS channel "A2" is tripped for about a minute as reactor pressure reaches the reactor high pressure trip setpoint. A half scram signal is present.

23:09:44 The "A2" high pressure signal clears.

23:09:47 The "A" channel half scram is reset.

*23:09 HPCI is manually started and placed in the "Pressure Control" mode. The turbine stop valve opens, closes and re-opens as was the case in the August 16 scram. (ESF actuation)

**/23:17:13/52 A second Reactor scram signal is generated. Cause is reactor low level. Channel A2 and B2 were the first to be tripped but all four channels did trip. Also received a full trip of both Group 2, 6 and 8 isolation logic. (ESF actuation/RPS trip)

*ESF Actuation
**RPS Trip

23:18 Manually started RCIC, and began an injection; level is being maintained but level is not being recovered.

23:23 HPCI is transferred from "Pressure Control" to "injection" mode and vessel level is returned above the low level 1 setpoint.

23:23 A Group 1 (Channel A1) trip is received. Probable cause is the 40% steam line flow signal. The half isolation is promptly reset and the inboard MSIV's are opened to restore the normal heat sink.

Reset of Group 2 and 3 isolation signals during the step above.

23:25 HPCI is manually secured from vessel injection. (ESF actuation)

23:26 Reactor scram is reset.

23:27 RCIC is tripped, trying to avoid high reactor level trip.

23:27 High reactor level trip is received.

23:50 The isolation valves for the drywell sumps are opened (G31-F003, F004, F019, and F020).

23:53 Reset and rolled "2B" Reactor Feed Pump (RFP) but could not feed the vessel because the Startup Level Control Valve (SULCV) would not open sufficiently. The Control Room does not have position indication on the valve. From local observation it appears the valve was responding but not fully stroking.

*ESF Actuation
**RPS Trip

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00:03:52 Channel "B2" detects a low reactor water level,

*/**00:04:10 Channel "A2" detects a low reactor water level and a full scram (third) is generated. The other two sub-channels do not have an opportunity to trip. Group "2B" and "6B" isolation commands are received. (ESF actuation/RPS trip)

00:04:12 Valves 2G16-F004 and F020 close in response to the Group 2B isolation signal.

*00:05 HPCI is started manually, injects, water level is returned to normal band and HPCI secured. Again the stop valve opens, closes and re-opens on the starting transient. (ESF actuation)

00:05:28 The scram is reset.

00:06 Throttled open the FW-V118 and attempted to control level by controlling RFP speed with the Motor Speed Changer.

00:07 Highest torus temperature attained is 108 deg. F. Highest torus level attained is -26.5".

00:13 SDV "A2" and "B2" reset.

00:14 SDV "B1" resets.

00:23 RFP turbine trips when system over feeds the vessel.

00:27:29 Group 3A isolation command.

00:27:32 Group 3B isolation command. Delta Flow is the probable cause as this is the only isolation that stems from a single instrumentation source. (ESF actuation)

00:27:53:57 Valves 2G31-F004 and F001 are full closed.

00:30 Operator reset Groups "2B", "6B", and both divisions of the Group 3 isolation signal. RWCU valve F001 and F004 are opened to restore a reject path.

00:31 SDV "A1" resets.

00:31 Condensate booster pump "2B" manually secured. Water level continues to increase due to apparent FW-V118 leakage.

*ESF Actuation
**RPS Trip

00:33 Valves 2G16-F004 and F020 opened.

00:40 Condensate booster pump "2A" manually secured to prevent water level from reaching the steam lines. Highest level reached is 250".

02:00 The RCIC trip and throttle valve (V8) cannot be reset. The thermals on the MOV are found tripped.

02:05 Reactor Building ventilation is restored.

02:17 Condensate booster pump "2A" started for vessel feed. Cannot open the pump discharge valve (2-COD-V4). Later determined the "magnetics" on the pump discharge valve had tripped.

02:20 Condensate booster pump "2B" started for vessel feed. Pump "2A" secured.

02:36 Secured SBGT and placed in standby.

End of Event

EVENT INVESTIGATION

Item 1 - Surveillance Test (Reference Sequence of Events 21:37 - 21:54)

The purpose of surveillance test 2MST-PCIS24M is to determine if the condenser low vacuum instrumentation and isolation logic is operable. The logic consists of four individual channels. Each channel is tested individually and is to be reset and independently verified before another channel can be tested. A check of the plant security computer revealed that one of the two assigned technicians (Technician 1) was not in the Control Room while 2MST-PCIS24M was being performed by the other technician (Technician 2). The two channels which had been tested were done without the benefit of an independent verification. The technician performing the test failed to have the Control Operator reset the A2(C) channel before testing the B2(D) channel. The failure to follow procedure guidance resulted in the closure of the MSIVs and a reactor scram.

Item 2 - Main Steam Isolation Valves (Reference Sequence of Events 21:54:50/52)

A review of the ERFIS data indicated that MSIVs B21-F022A closed in 3.025 seconds and that B21-F022B stroked too fast (2.51 seconds. Inspection of these two inboard MSIVs revealed fluid leakage from the hydraulic actuators which can result in fast closing times. The seals/bushings were replaced on these actuators, the times reset, and the valves returned to service with satisfactory stroke times. The other inboard MSIVs (B21-F022C and B21-F022D) did not have leaking actuators. The outboard MSIVs were not checked since the

*ESF Actuation
**RPS Trip

outboard MSIV pit was not accessible.

Item 3 - Safety Relief Valves (Reference Sequence of Events 21:55:08/12, 21:56:25, 21:58:58)

Control Room personnel questioned the opening sequence/setpoints of the SRVs at the outset. They noted that some safety relief valves with lower pressure setpoints did not open (see Attachment 1 for location). Safety Relief Valve B21-F013C (setpoint 1105 +/= 11 psig) did not open even though the other valves on the main steam line "B" did open (B21-F013D, E, and L) and B21-F013A (setpoint 1105 + 11 psig) appeared to not fully open, It is thought that B21-1F013A (located on main steam line "A") did not fully open because reactor pressure was decreasing rapidly (approximately 1092 psig) from the relief action being provided by B21-F013D, E, F, and L (B21-F013F is located on main steam line C, setpoint 1105 +/= 11 psig). The valve then reseated without showing a noticeable increase in tailpipe temperature. A review of the ERFIS data revealed that it was predominantly valves located on main steam line B that lifted. The SRV actuation pattern is not inconsistent when compared to previous scrams on Unit 1 and Unit 2. General Electric was also contacted concerning the actuation pattern and explained that valve openings of different setpoint valves on one line can be attributed to the shock wave that travels in the direction of the reactor following the opening of the first valve. It was also stated that the phenomenon does not always occur. Based upon the

information known, it is felt that B21-F013C should have opened along with the other valves on main steam line "B". Safety relief valve, B21-F013C had indicated a higher than normal temperature since the outage. Prior to this event, both the pilot valve and main valve assembly were changed and the temperature still remained higher than the other SRV temperatures. Following this event, the pilot valve was changed again on B21-F013C. In addition, the pilot assemblies were replaced on B21-F013A, G, H, and K. These five pilot assemblies were sent to Wyle Laboratories to determine the as received setpoints. The five pilot assemblies were tested four times each. On the initial test, none of the valves were within the allowed 1% tolerance (+/= 11 psig). By the end of the fourth test, all of the valves were within the 1% tolerance allowed by T/S. The following test results were obtained. The difference in the test results are indicative of bonding between the pilot seat and pilot disc. This is a generic BWR issue with two stage Target Rock valves.

Safety Relief Valve Setpoint Test 1 Test 2 Test 3 Test 4

B21-F013A 1105 +/= 1% 1119 1119 1117 1116
B21-F013A 1105 +/= 1% 1142 1103 1115 1116
B21-F013C 1105 +/= 1% 1241 1115 1107 1113
B21-F013G 1105 +/= 1% 1176 1121 1117 1112
B21-F013H 1115 +/= 1% 1149 1130 1123 1124

At the time of the scram, the question arose as to why the other SRVs (B21-F013A and B21-F013G) with a setpoint of 1105 psig did not lift. Plant management felt that additional time was necessary to determine if an SRV failure had occurred. An Unusual Event, due to the failure of a safety relief valve to open if challenged, was declared at 1745 on 8/20/90.

Several problems were encountered when the Emergency Plan was implemented. The notification of the State Warning Point was made one minute late (selective signalling problem), times were not documented for off-site notifications, times were not documented for notification of required personnel, and Corporate Communications was not notified.

Item 4 - Reactor Vessel Level Control (Reference Sequence of Events 22:13, 23:17:13/52, 00:04:10)

To maintain reactor vessel level above the low level 1 trip setpoint (162.5"), HPCI and RCIC were stopped, started, and alternately swapped between pressure control and injection modes of operation. Controlling reactor water level above the low level 1 trip setpoint with HPCI and RCIC proved to be difficult and resulted in two additional RPS trips and ESF actuations. At 2323, the MSIVs were reopened. The 2B Reactor Feed Pump (RFP) was reset, rolled at 2353 but could not be used to feed the reactor vessel because the Startup Level Control Valve would not respond. An Auxiliary Operator verified locally that the SULCV was opening and closing. The SULCV was replaced during the last Unit 2 outage with a valve that did not have the same flow characteristics. The operating band is not linear. The first part of the valve stroke allows a smaller flow increase than the latter part. A parallel flow path was established through the A high pressure feedwater heater train by opening the outlet and inlet valves (FW-V6 and FW-V118). Reactor water level could not be controlled and the RFP tripped on a high level at 0023. FW-V118 was closed. The vessel level continued to increase and was finally stopped at 250" after tripping both condensate booster pumps at 0040. After vessel level was lowered using RWCU reject, a condensate booster pump was started and the SULCV was placed in service with no problems noted at 0224.

Item 5 - ESF Actuations/RPS (See * for ESF actuations and for RPS trips in the Sequence of Events) The ESF actuations being reported are:

21:54:48 Group 1 isolates in response to the surveillance test being performed.

21:54:50 Group 2, 6, and 8 isolations result from a low level 1. The low level 1 is in response to the void collapse and the increase in reactor pressure immediately following the MSIV closure.

Another Group 1 isolation signal is being attributed to a high main steam line flow signal

generated by pressure variations in the steam line during MSIV closure.

21:54:53/56 Low level 2 is reached due to the void collapse. A Group 3 (RWCU) isolation occurs. Both HPCI and RCIC receive an auto start signal. An isolation signal is generated for the Reactor Building ventilation supply and exhaust dampers and both SBGT trains start.

21:55:08/12 SRVs B21-F013D, E, F, and L automatically opened to relieve reactor pressure.

21:55:42/43 HPCI and RCIC turbines receive a high water level signal and stop running.

21:56/25 SRV B21-F013 is manually opened by the operator to lower reactor pressure below the scram setpoint.

21:58:58 SRV B21-F013F is manually opened by the operator to maintain the pressure below the scram setpoint.

22:00 HPCI is manually started and is placed in the pressure control mode to alleviate the need to manually operate SRVs.

22:07 Torus cooling is commenced using RHR Loop A. Cooling of the torus is required to support HPCI operation and to remove the heat added by SRV operation.

22:13 The reactor vessel level reaches the low level 1 setpoint. RCIC is started but cannot supply sufficient inventory to account for the HPCI steam load. HPCI is swapped from the pressure control to the injection mode of operation to aid in level restoration.

22:14 RHR Loop B is placed in torus cooling to provide additional cooling to support HPCI operation.

22:26/27 With no steam available to the SJAEs, a Group 1 isolation is received due to a true low condenser vacuum. Only the outboard MSIVs and the inboard steam line drain valve closed. The inboard MSIVs have not been reopened following the scram and the outboard drain valve remained open due the B2 channel still being in test.

22:34 HPCI trips on a high level. Attempts were made to prevent this from occurring. HPCI was diverted to

the pressure control mode and RCIC was manually secured.

23:09 HPCI was manually restarted in the pressure control mode. A data review of this third HPCI start indicated that the stop valve opened (HPCI turbine did not roll), then closed, and then reopened (HPCI starts). The Control Operator realized after resetting the high water level trip and opening E41-F001 (steam admission valve) that the auxiliary oil pump (AOP) was still running and that the turbine stop valve was full open. The Control Operator knew from experience that the E41-F001 valve is opened before the AOP is started to enforce a proper start sequence. To ensure a smooth start and prevent possible tripping or damage to the turbine, the operator secured the AOP which closed the stop valve. The operator then started HPCI by opening E41-F001 and starting the AOP.

23:17:13/52 A second reactor scram signal is generated resulting in a Group 2, 6 and 8 isolation. This low level condition was caused by insufficient makeup. HPCI and RCIC were running in the pressure control mode to aid in equalizing around the MSIVs. The operator secured RWCU reject. The makeup available from CRD was insufficient to maintain the vessel level. HPCI and RCIC were swapped from pressure control to injection to restore vessel level. HPCI and RCIC were secured after the main condenser becomes available as a heat sink. This was performed to avoid a high reactor water level trip but one is received anyway at 2327.

00:04:10 A Group 2B and 6B isolation were received and valves G16-F004 and G16-F020 closed in response to Group 2B isolation signal. This isolation was caused by a low level 1. The low level occurred while attempting to feed the vessel with the 2B RFP and SULCV. After several attempts to establish flow to the vessel through the SULCV, HPCI was started manually at 00:05 and the turbine stop valve responded as it did during the third HPCI start. HPCI was secured after level was increased to allow the scram to be reset.

Vessel level continued to increase as another flow path was established using the A feedwater heater drain. The RFP finally tripped on a high level at 0023.

00:27 A Group 3 isolation occurred due to a high-high leak condition being sensed. The isolation signal was momentary and was due to instrument leg flashing. The operator immediately reset the isolation and placed RWCU in-service rejecting to the condenser hotwell. This effort was

insufficient to regain control of vessel level and both in service condensate booster pumps (CBP) had to be tripped. The highest level reached was 250". When vessel level returned to normal, the 2B CBP was restarted and the now operating SULCV was placed in service.

The RPS trips being reported are:

21:54:48 MSIVs closed following incorrect performance of a surveillance test.

21:54:50 A low level 1 and reactor high pressure trip follow the MSIV closing.

21:55:05 The turbine stop valve and turbine control valve fast closure signals are sensed when the turbine trips.

21:55:17/23 A high-high level is detected in the scram discharge volume,

22:13 A low level 1 occurred due to insufficient makeup.

23:17:13/52 A low level 1 occurred due to insufficient makeup.

00:04:10 A low level 1 occurred due to problems with the SULCV.

Item 6 - Excessive RPV Cooldown Rate (Reference Sequence of Events 21:54:52)

Temperatures measured in the bottom head region exceeded 100

deg. F/hr. Contributing to this was a partially plugged bottom head drain line and the tripping of the recirculation pumps. General Electric (GE) was asked to perform an analysis to determine compliance with Technical Specification requirements. GE concluded that the 100 deg. F/hr. cooldown limit was not exceeded. To determine adherence to the 100 deg. F/hr. requirement, it is necessary to use the steam dome temperature (based on pressure) whenever reactor temperature is >212 deg. F. The steam dome temperature remained above 212 deg. F and no cooldown limit was exceeded.

Item 7 - Equipment Electrical Problems (Reference Sequence of Events 0200 and 0217)

While attempting to reset a RCIC turbine trip, the turbine trip and throttle valve (E51-V8) motor tripped thermally. This was the fourth motor start in a short period of time. The motor was designed for a duty cycle of three (3) motor starts in a five (5) minute period followed by a fifty (50) minute cooldown. A recent modification (last refueling outage) to the overload protection circuit offered better motor protection but also increased the

likelihood of a thermal overload relay actuation if the duty cycle is exceeded. No other equipment problems were identified that contributed to the thermal trip.

When the 2A CBP was restarted to feed the vessel, the pump discharge valve (2-COD-V4) would not open. An investigation revealed a magnetic trip of the breaker. The magnetic setting was found at position 2 and was reset to position 5. The motor was bridged/meggered and did not reveal any motor problems. No evidence of mechanical binding was noted when the valve was stroked electrically and the direction of rotation was satisfactory.

Not shown in the sequence of events was the thermal trip of the 2B Steam Packing Exhauster (SPE). The 2A SPE was started. The 2B SPE stopped because of excessive moisture.

EVENT CAUSE

The cause of the scram was a personnel error. A plant I&C technician did not follow the procedure in that one channel was not reset before testing

began in another channel and independent verification requirements were ignored.

A contributing factor is the communications between the Control Room personnel and the I&C technician were not adequate and the test status was not well understood. When a discussion took place between the Control Operator and the I&C technician, each party was talking about a different trip signal. The Control Operator was concerned about the long duration of the trip signal present (A2) but the I&C technician thought that the trip being discussed was the result of a signal spike associated with the testing being performed on the B2 channel.

CORRECTIVE ACTION TAKEN

It was determined that no changes to MST-PCIS24M are required. A decision was made to repeat any maintenance surveillance test performed by the involved technicians on 8/19/90. Maintenance surveillance tests, 2MST-PCIS24M and 2MST-PCIS22M, were performed again with no problems noted. A Human Performance Enhancement System (HPES) evaluation is to be performed by 9/14/90. Subunit management conducted briefings on the event and the cause of the event with maintenance personnel on 8/20/90. Communications expectations were held with I&C personnel on 8/24/90. Other items and corrective actions are listed below.

1. MSIVs, B21-F022A and B21-F022B appeared to close too fast. The seals and bushings were replaced on the leaking hydraulic actuators and the closing time was adjusted (3.82 secs. for B21-F022A and 4.04 secs. for B21-F022B). Technical Support will provide a root cause determination,

2. SRV operation and setpoints are a concern. An action plan for evaluation of SRV performance was prepared by Technical Support. The pilot valves were replaced on SRVs A, C, G, H and K. All eleven (11) SRVs were tested satisfactorily on 8/30/90. Technical Support is continuing to monitor the high tailpipe temperature on B21-F013C. The sonic detector for SRV B21-F013E was not tightly attached to the piping. The strap holding the detector in place had stretched slightly as a result of thermal cycling. The strap was tightened

and the sonic detector was tested satisfactorily on 8/27/90. Even though B21-F013F. and B21-F013F both exhibited an unusual thermocouple response (did not show an expected rapid increase in tailpipe temperature when opened), it is felt that both SRVs

did open and relieved pressure. Individual SRV setpoint variation and plant response will be evaluated for simulator modelling.

3. Problems were encountered with vessel level control. With a Group 1 isolation present, HPCI, RCIC, CRD, and RWCU flows could not be balanced to control vessel level between 170 and 200 inches which resulted in unnecessary ESF actuations and trips. Once the MSIVs were reopened, difficulty in controlling vessel level with a RFP and the SULCV led to additional ESF actuations and RPS trips. No specific equipment problems that would account for the inability to control reactor vessel level were found. The following recommendations were made to improve vessel level control.

a) Calibrate the SULVC control loop prior to the next startup Work Request/Job Order (WR/JO 90-ANYM1) was completed on 8/27/90.

b) Evaluate the simulator to realistically model SULVC flow characteristics.

c) Review current operating procedures for changes in operation of the SULCV and FW-V177 (feedwater reject to the condenser). Provide simulator training for changes that are made.

d) Review the operation (flow characteristics) of the SULCV with the Operations Staff. Completed. Operator aid provided.

e) Consider installation of a flow meter/valve position indicator in the Control Room to provide additional status of the SULCV and feed flow to the vessel.

f) Require Direct Replacement packages (DRP) to contain procedural guidance for simulator upgrade whenever equipment changes are made in the plant.

g) Review and revise as necessary the pneumatic valve stroking procedures to determine the proper setup method for modulating valves.

h) Investigate the calibration records for the Unit 1 SULCV and report the results to Operations. If required, recalibrate the valve during the next

refueling outage,

i) Review current operating procedures for changes in operation that would be necessary if the SULCV or FW-V177 were to be inoperable.

j) Provide simulator exercises emphasizing vessel level and level control (establish and maintain vessel level

between 170 and 200 inches) with a Group 1 isolation and various equipment/component malfunctions to reduce the number of ESF actuations and RPS trips in a post-trip atmosphere.

4. An evaluation was performed and the cooldown rate was determined not to be excessive. The information provided by General Electric will be reviewed against current practices and procedures.

5. Equipment electrical problems serve to complicate an event further. Another steam packing exhauster and condensate booster pump were available and RCIC was no longer needed for pressure or level control when E51-V8 tripped on thermals. Actions to prevent recurrence of E51-V8 thermal trips are being evaluated by the RCIC system engineer, Operations, and Technical Support. If feasible, perform simulation of thermal trips on valves that are subject to cycle restraints utilizing the plant simulator. The increased number of motor-operated valve problems (thermal trips, magnetic trips, torque switch settings) warrants a review to determine if current maintenance procedures are adequate.

6. Appropriate disciplinary action was taken for the I&C technicians.

7. The following recommendations were made to improve the response to an Unusual Event declaration.

a) Evaluate the different aspects of SRV operation and develop a policy for identification and declaration of the appropriate Emergency Event.

b) Repairs were made to the selective signalling system

for the State Warning Point. Completed 8/20/90.

c) Provide additional training for the Emergency Communicators on the use of the communication forms contained in the Plant Emergency Plan.

d) Investigate using the Production Assistants (Emergency Communicator) during Emergency Plan simulator training.

EVENT ASSESSMENT

No safety limits were exceeded during the plant response to the level and pressure transients. A review of the equipment problems did not reveal a significant safety concern nor did they hamper the ability of the operators to control the plant. Redundant equipment was available and used as required or backup methods were implemented. The minimum water level reached was approximately 112 inches and reactor pressure peaked at approximately 1133 psig.

Similar events have been reported in LERs 2-88-005 (SRV tolerance), 2-88-019 (SULCV failure), 2-87-004 (Group 1,2,6,8-HPCI/RCIC injection), 1-87-011 (SRV tolerance), 2-86-001 (SRV tolerance), 2-86-013 (RPS trip while performing a surveillance test), 2-86-016 (RPS trip on low level), 2-86-017 (RPS trip on low level), 2-85-003 (Group 1 while performing a surveillance test), 2-85-011 (Rx.

scram, Group 1 isolation), and 1-85-033 (SRV tolerance).

EIIS CODES

Reactor Recirculation AD
SBGT BH
HPCI BJ
RCIC BN
RWCU CE
Annunciator IB
Sequence of Events Mon. IQ
Reactor Building NG
Rx. Power Control JD
Condensate SD
Condenser SG
Feedwater SJ
Main Turbine TA

Main Generator TB
Rx. Bldg. Env. Control VA
Equipment and Floor Drain WK

Figure "ADS VALVE MAIN STEAM LINE ASSIGNMENTS" omitted.

Figure "Valve Schematic (Open Position)" omitted.

CP&L
Carolina Power & Light Company

Brunswick Nuclear Project
P.O. Box 10429
Southport, N.C. 28461-0429

September 18, 1990

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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

BRUNSWICK STEAM ELECTRIC PLANT UNIT 2
DOCKET NO. 50-324
LICENSE NO. DPR-62
LICENSEE EVENT REPORT 2-90-009

Gentlemen:

In accordance with Title 10 of the Code of Federal Regulations, the enclosed Licensee Event Report is submitted. This report fulfills the requirement for a written report within thirty (30) days of a reportable occurrence and is submitted in accordance with the format set forth in NUREG-1022, September 1983.

Very truly yours,

J. L. Harness, General Manager

Brunswick Nuclear Project

WDL/

Enclosure

cc: Mr. S. D. Ebneter
Mr. N. B. Le
BSEP NRC Resident Office

*** END OF DOCUMENT ***